YASKAWA

YASKAWA AC Drive 1000-Series Option

Analog Monitor
Installation Manual

Type AO-A3

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.

安川インバータ 1000シリーズ オプション

アナログモニタ
取扱説明書

形式 AO-A3

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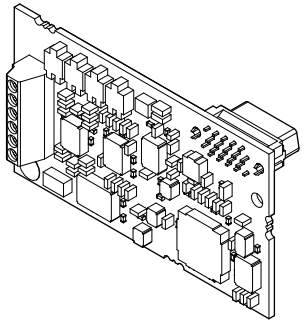

MANUAL NO. TOBP C730600 40C

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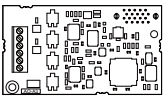
1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

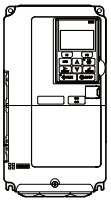
◆ Applicable Documentation

The following manuals are available for the option:

Analog Monitor AO-A3 Option

	**Yaskawa AC Drive 1000-Series Option Analog Monitor AO-A3 Installation Manual (This book) Manual No: TOBPC73060040**	Read this manual first. The installation manual is packaged with the option and contains information required to install the option and set up related drive parameters.

Yaskawa Drive

	**Yaskawa AC Drive 1000-Series Quick Start Guide**	The drive manuals cover basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information. The manuals also include important information about parameter settings and drive tuning. Access these sites to obtain Yaskawa instruction manuals: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com For questions, contact your local Yaskawa sales office or the nearest Yaskawa representative.
	Yaskawa AC Drive 1000-Series Technical Manual	

◆ Terms

Note: Indicates supplemental information that is not related to safety messages

Drive: Yaskawa AC Drive 1000-Series

Option: Yaskawa AC Drive 1000-Series Option Analog Monitor AO-A3

◆ Registered Trademarks

Trademarks are the property of their respective owners.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. Install the option according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

⚠ DANGER

Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates an equipment damage message.

■ General Safety

General Precautions
• The diagrams in this book may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. Use the option according to the instructions described in this manual. • Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable. • The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual. • When ordering new copies of the manual, contact a Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

NOTICE

Do not modify the drive or option circuitry.

Failure to comply could result in damage to the drive or option and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

Do not expose the drive or option to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the drive or option.

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

2 Product Overview

◆ About This Product

The Analog Monitor Option AO-A3 allows the user to expand the number of available analog outputs to monitor drive performance.

The option uses drive parameter settings and the output signal gain and bias to assign functions to output terminals V1 and V2.

The option has two analog outputs, an 11-bit signed (1/2048) output resolution, and a -10 to 10 Vdc non-isolated output voltage.

◆ Applicable Models

The option can be used with the drive models in ***Table 1***.

Table 1 Applicable Models

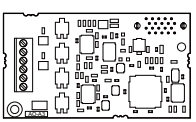
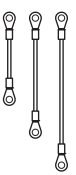
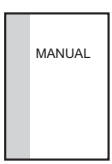
Drive Series	Drive Model Number
A1000	All models
L1000A	All models

3 Receiving

Please perform the following tasks upon receiving the option:

- Inspect the option for damage. Contact the shipper immediately if the option appears damaged upon receipt.
- Verify receipt of the correct model by checking the model number printed on the option nameplate. (Refer to ***Figure 1*** on page ***9*** for more information)
- Contact your supplier if you have received the wrong model or the option does not function properly.

◆ Option Package Contents

Description:	Option	Ground Wires	Screws (M3)	Installation Manual
–				
Quantity:	1	3	3	1

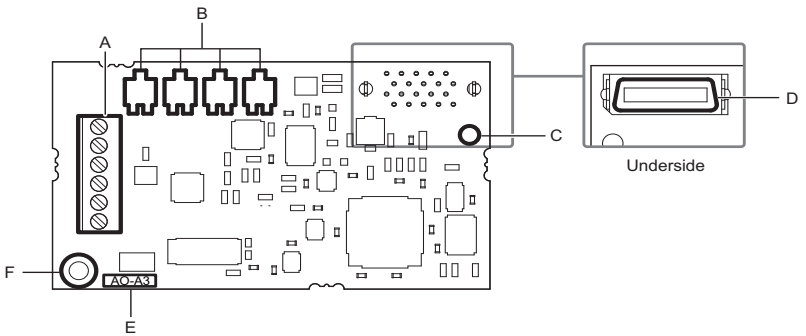
◆ Tools Required for Installation

- A Phillips screwdriver (M3 metric / #1, #2 U.S. standard size) is required to install the option.
- A straight-edge screwdriver (blade depth: 0.4 mm, width: 2.5 mm) is required to wire the option terminal block.
- A pair of diagonal cutting pliers.
- A small file or medium-grit sandpaper.

Note: Tools required to prepare option cables for wiring are not listed in this manual.

4 Option Components

◆ Analog Monitor AO-A3 Option

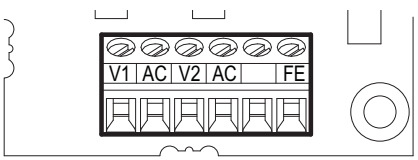


A – Terminal Block TB1
B – Potentiometers *<1>*
C – Installation hole
D – Connector (CN5)
E – Model number
F – Ground terminal and installation hole *<1>*

<1> **NOTICE:** Do not adjust the potentiometers on the option. The potentiometers are factory set and may change the voltage output characteristics and cause output signal inaccuracy if misadjusted.
<2> The ground wires provided in the option shipping package must be connected during installation.

Figure 1 Analog Monitor AO-A3 Option Components

◆ Terminal Block TB1



Refer to *Table 4* on page *21* for details on TB1 terminal functions and signal levels.

5 Installation Procedure

◆ Section Safety

⚠ DANGER

Electric Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing. The internal capacitor remains charged after the power supply is turned off.

⚠ WARNING

Electrical Shock Hazard

Do not remove the front covers of the drive while the power is on.

Failure to comply could result in death or serious injury.

The diagrams in this section may include options and drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. Use the option according to the instructions described in this manual.

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of this product.

Do not touch circuit boards while the power to the drive is on.

Failure to comply could result in death or serious injury.

Do not use damaged wires, stress the wiring, or damage the wire insulation.

Failure to comply could result in death or serious injury.

⚠ WARNING

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards.

Failure to comply may result in ESD damage to circuitry.

Never shut the power off while the drive is running or outputting voltage.

Failure to comply may cause the application to operate incorrectly or damage the drive.

Do not operate damaged equipment.

Failure to comply may cause further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Tighten all terminal screws to the specified tightening torque.

Failure to comply could result in damage to the terminal block.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance.

Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Properly connect all pins and connectors.

Failure to comply may prevent proper operation and possibly damage equipment.

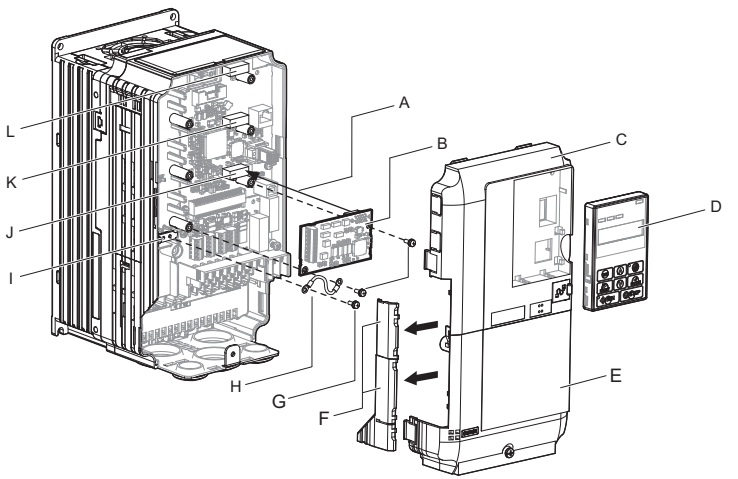
Check wiring to ensure that all connections are correct after installing the option and connecting any other devices.

Failure to comply may result in damage to the option.

◆ Prior to Installing the Option

Prior to installing the option, wire the drive, make the necessary connections to the drive terminals, and verify that the drive functions normally. Refer to the Quick Start Guide packaged with the drive for information on wiring and connecting the drive.

Figure 2 shows an exploded view of the drive with the option and related components for reference.



A – Insertion point for CN5
B – Option card
C – Front cover
D – Digital operator
E – Terminal cover
F – Removable tabs for wire routing
G – Included screws
H – Ground wire
I – Drive grounding terminal (FE)
J – Connector CN5-A
K – Connector CN5-B
L – Connector CN5-C

Figure 2 Drive Components with Option

◆ Installing the Option

Refer to the instructions below to install the option.

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (D), front cover (C), and terminal cover (E). Cover removal varies depending on drive size. Refer to the Quick Start Guide packaged with the drive for directions on removing the covers.

DANGER! *Electrical Shock Hazard. Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off.*

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the option, drive, and circuit boards. Failure to comply may result in ESD damage to circuitry.*

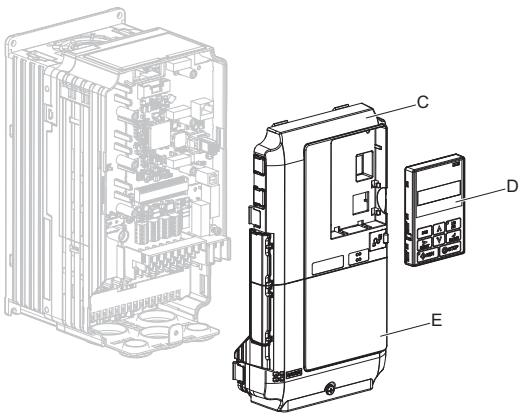


Figure 3 Remove the Front Cover, Terminal Cover, and Digital Operator

2. Insert the option card (B) into the CN5-A (J), CN5-B (K), or CN5-C (L) connector located on the drive and fasten it into place using one of the included screws (G).

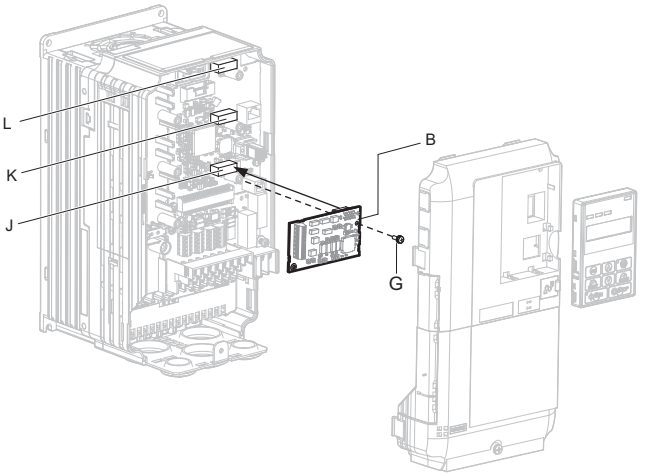


Figure 4 Insert the Option Card

3. Connect one end of the ground wire (H) to the ground terminal (I) using one of the remaining screws (G). Connect the other end of the ground wire (H) to the remaining ground terminal and installation hole on the option (B) using the last remaining provided screw (G).

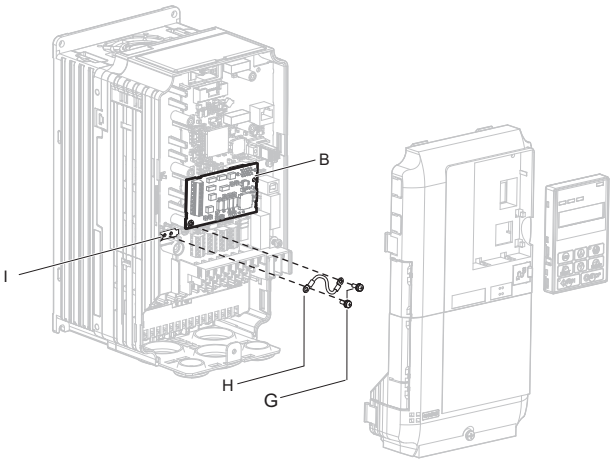


Figure 5 Connect the Ground Wire

Note: **1.** The option package includes three ground wires. Use the longest wire when plugging the option into connector CN5-C on the drive side. Use the next longest wire when plugging the option into connector CN5-B. Use the shortest wire when plugging the option into connector CN5-A. Refer to ***Option Package Contents on page 8*** for more information.

2. There are two screw holes on the drive for use as ground terminals (J). When connecting three options, two ground wires will need to share the same drive ground terminal.

4. Prepare and connect the wire ends as shown in ***Figure 6*** and ***Figure 7***. Refer to ***Wire Gauges and Tightening Torques on page 20*** to confirm that the proper tightening torque is applied to each terminal. Take particular precaution to ensure that each wire is properly connected and wire insulation is not accidentally pinched into electrical terminals.

WARNING! *Fire Hazard. Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may cause erroneous operation, damage the terminal block, or cause a fire.*

NOTICE: *Heat shrink tubing or electrical tape may be required to ensure that cable shielding does not contact other wiring. Insufficient insulation may cause a short circuit and damage the option or drive.*

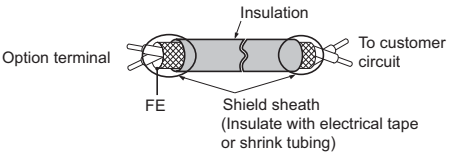


Figure 6 Preparing Ends of Shielded Cable

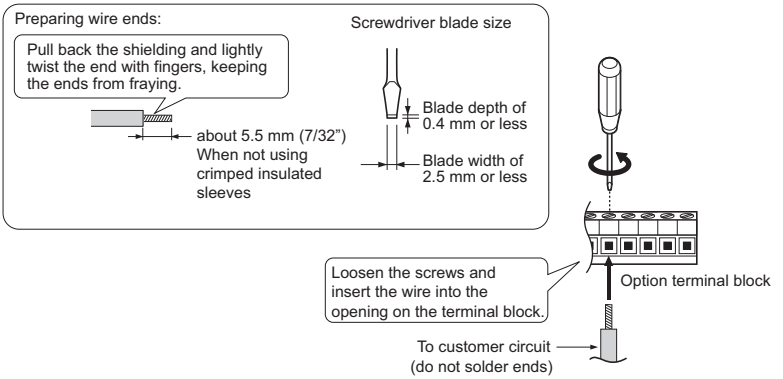

Preparing wire ends:
Pull back the shielding and lightly twist the end with fingers, keeping the ends from fraying.
about 5.5 mm (7/32")
When not using crimped insulated sleeves
Screwdriver blade size
Blade depth of 0.4 mm or less
Blade width of 2.5 mm or less
Loosen the screws and insert the wire into the opening on the terminal block.
Option terminal block
To customer circuit
(do not solder ends)

Figure 7 Preparing and Connecting Cable Wiring

5. Wire the customer-supplied circuit to the terminal block on the option. Refer to ***Figure 8*** for wiring instructions.

Connection Diagram
Refer to ***Table 4*** on page ***21*** for a detailed description of the option board terminal functions. To ensure accurate control, use stable power supply for the voltage reference source.

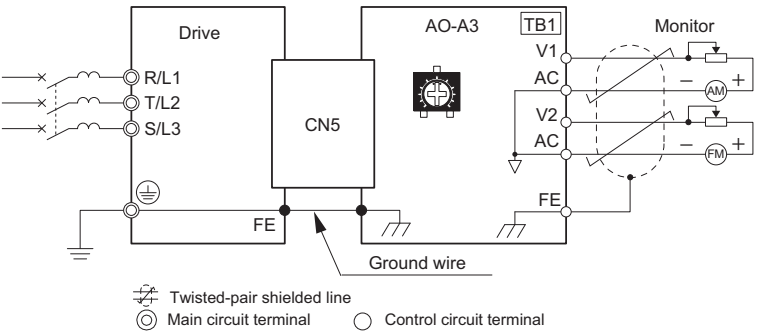
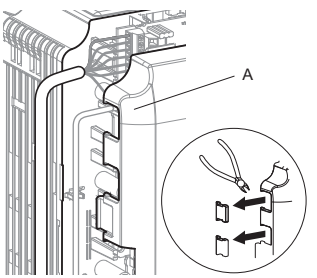
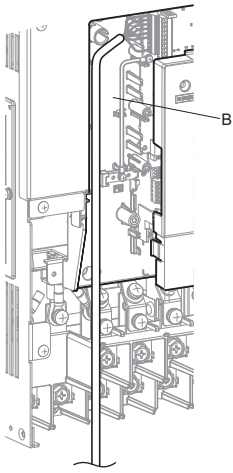


Figure 8 Option Connection Diagram

NOTICE: *Do not adjust the potentiometers on the option. The potentiometers are factory set and may change the voltage output characteristics and cause output signal inaccuracy if misadjusted.*

6. Route the option wiring.
Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside. In these cases, cut out the perforated openings on the left side of the drive front cover as shown in ***Figure 9-A*** and leave no sharp edges to damage wiring.
Route the wiring inside the enclosure as shown in ***Figure 9-B*** for drives that do not require routing through the front cover.
Refer to the Peripheral Devices & Options section of the drive Technical Manual for more information.





A – Route wires through the openings provided on the left side of the front cover. *<1>*

B – Use the open space provided inside the drive to route option wiring.

<1> The drive will not meet NEMA Type 1 requirements if wiring is exposed outside the enclosure.

Figure 9 Wire Routing Examples

7. Replace and secure the front covers of the drive (C, E) and replace the digital operator (D).

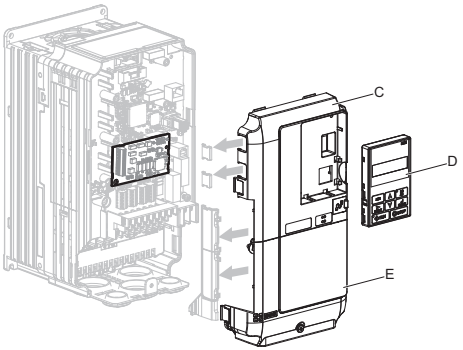


Figure 10 Replace the Front Covers and Digital Operator

Note: Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure cables are not pinched between the front covers and the drive when replacing the covers.

8. Set drive parameters in ***Table 5*** for proper option performance.

◆ Wire Gauges, Tightening Torques, and Crimp Terminals

■ Wire Gauges and Tightening Torques

Wire gauge and torque specifications are listed in ***Table 2***.

Table 2 Wire Gauges and Tightening Torques

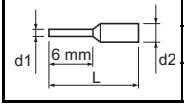
Terminal signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Cable		Crimp Terminals		Wire Type
			Applicable Gauges mm^2	Recomm. Gauge mm^2	Applicable Gauges mm^2	Recomm. Gauge mm^2	
V1, V2, AC, FE	M2	0.22 to 0.25 (1.95 to 2.21)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.75 (18 AWG)	0.25 to 0.5 (24 to 20 AWG)	0.5 (20 AWG)	Shielded twisted pair, etc.

■ Crimp Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp terminals with the specifications listed in ***Table 3*** for wiring to ensure proper connections.

Note: Properly trim wire ends so loose wire ends do not extend from the crimp terminals.

Table 3 Crimp Terminal Sizes

	Wire Gauge mm^2	Phoenix Contact Model	L mm (in)	d1 mm (in)	d2 mm (in)
	0.25 (24 AWG)	AI 0.25 - 6YE	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.34 (22 AWG)	AI 0.34 - 6TQ	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.5 (20 AWG)	AI 0.5 - 6WH	14 (9/16)	1.1 (3/64)	2.5 (3/32)

◆ Terminal Functions

Table 4 Option Terminal Functions

Terminal	Function	Signal Level	Description
V1	Analog voltage output 1	-10 to 10 V	• Analog voltage output for an external monitoring device <1> Output resolution 11-bit plus sign (1/2048) • Max. load current 3 mA
V2	Analog voltage output 2		
AC	Common	0 V	Common for analog voltage output
FE	Ground	–	Used for grounding shielded lines

<1> Set the functions and output levels for terminals V1 and V2 using drive parameters. See the drive Quick Start Guide or Technical Manual for directions on setting parameters.

6 Related Parameters

The parameters outlined in the following sections are used to set up the drive for operation with the option. Set parameters as needed. Parameter setting methods can be found in the drive Quick Start Guide or Technical Manual.

◆ Parameter Table

Table 5 Related Parameters

No. (Addr. Hex)	Name	Description	Values
F4-01 (391)	Terminal V1 Monitor Selection	Sets the monitor signal for output from terminal V1. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes. For example, enter “103” for U1-03.	Default: 102 (output frequency) Range: 000 to 999
F4-02 (392)	Terminal V1 Monitor Gain	Sets the gain for voltage output via terminal V1, where 100% equals 10 V output. Terminal output voltage is limited to 10 V.	Default: 100.0% Min: -999.9 Max: 999.9
F4-03 (393)	Terminal V2 Monitor Selection	Sets the monitor signal for output from terminal V2. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes. For example, enter “103” for U1-03.	Default: 0.0% Min: -999.9 Max: 999.9
F4-04 (394)	Terminal V2 Monitor Gain	Sets the gain for voltage output via terminal V2, where 100% equals 10 V output. Terminal output voltage is limited to 10 V. <1>	Default: 50.0% Min: -999.9 Max: 999.9
F4-05 (395)	Terminal V1 Monitor Bias	Sets the amount of bias added to the voltage output via terminal V1. <1>	Default: 0.0% Min: -999.9 Max: 999.9
F4-06 (396)	Terminal V2 Monitor Bias	Sets the amount of bias added to the voltage output via terminal V2. <1>	Default: 0.0% Min: -999.9 Max: 999.9
F4-07 (397)	Terminal V1 Signal Level	Sets the voltage level for the analog output. 0: 0 to +10 Vdc 1: -10 to +10 Vdc	Default: 0 Range: 0, 1
F4-08 (398)	Terminal V2 Signal Level		Default: 0 Range: 0, 1

<1> The drive outputs voltage while this parameter is being adjusted. Voltage levels can be adjusted to match the specifications of an external meter.

7 Troubleshooting

◆ Drive-Side Error Codes

Table 6 lists the various fault codes related to the option. Refer to the drive Technical Manual for further details on fault codes.

Check the following items first when an error code occurs on the drive:

- Are the cables connected properly and securely?
- Is the option is properly installed to the drive?
- Did a momentary power loss occur?

Table 6 Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
oFA01	oFA01	Option Fault (CN5-A) Option is not properly connected
Cause		**Possible Solution**
Option at drive port CN5-A was changed during run.		Turn the power off and check the connectors between the drive and option.
Digital Operator Display		**Fault Name**
oFb01	oFb01	Option Fault (CN5-B) Option is not properly connected
Cause		**Possible Solution**
Option at drive port CN5-B was changed during run.		Turn the power off and check the connectors between the drive and option.
Digital Operator Display		**Fault Name**
oFb02	oFb02	Option Fault (CN5-B) Two of the same options are connected simultaneously.
Cause		**Possible Solution**
Same type of option connected to ports CN5-A and CN5-B.		Use only compatible options.
Digital Operator Display		**Fault Name**
oFC01	oFC01	Option connection error at drive port CN5-C
Cause		**Possible Solution**
Option at drive port CN5-C was changed during run.		Turn the power off and check the connectors between the drive and option.

Digital Operator Display		Fault Name
oFC02	oFC02	Option Fault (CN5-C)
		Two of the same options are connected simultaneously.
Cause		**Possible Solution**
Same type of option connected to drive ports CN5-A, CN5-B, and CN5-C.		Use only compatible options.

◆ Preventing Noise Interference

Take the following steps to prevent erroneous operation caused by noise interference:

- Use shielded wire for the signal lines.
- Limit the length of wiring under 50 m (164 ft.).
- Separate the control wiring to the option, main circuit wiring, and power lines.

■ Interface Circuit

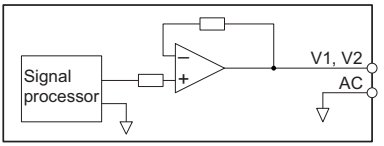


Figure 11 Output Interface Circuit

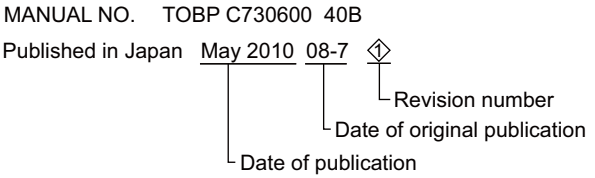
8 Specifications

Table 7 Option Specifications

Item	Description
Model	AO-A3
Analog Output Terminals	2 terminals
Voltage Output	• Output signal voltage: -10 to 10 Vdc • Output resolution: 11 bit plus sign (1/2048) • Max. load current: 3 mA
Ambient Temperature	-10 °C to +50 °C (14 °F to 122 °F)
Humidity	95% RH or lower with no condensation
Storage Temperature	-20 °C to +60 °C (-4 °F to 140 °F) allowed for short-term transport of the product
Area of use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	1000 m (3280 ft.) or lower

◆ Revision History

Revision dates and manual numbers are located on the bottom of the back cover.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July 2010	②	Entire Document	Edited for procedural clarity and readability.
		Back cover	Revision: Address
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July 2008	–	–	First edition

YASKAWA AC Drive 1000-Series Option

Analog Monitor
Installation Manual

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